VXS to solve even most challenging data transfer requirements

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VXS IS THE SWITCHED SERIAL BACKPLANE FABRIC FOR VMEBUS PROMISING TO SOLVE EVEN THE MOST CHALLENGING DATA TRANSFER REQUIREMENTS. THE VXS SPECIFICATION WAS DEFINED TO BE FABRIC AGNOSTIC, HAVING FIVE SUB-SPECIFICATIONS — FOR INFINIBAND, STARFABRIC, PCIEXPRESS, HYPER TRANSPORT AND RAPIDIO.

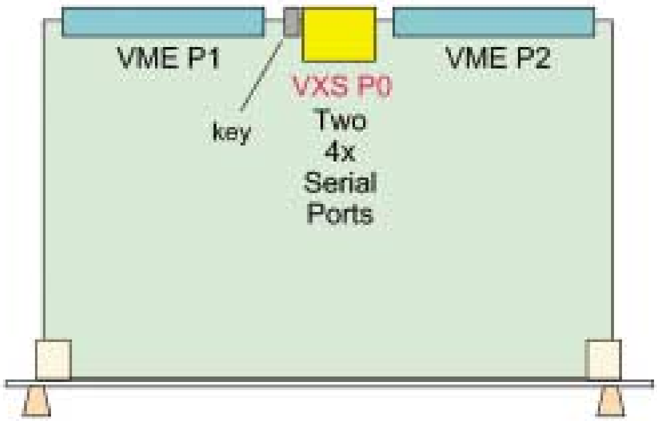

Figure 1. VXS Payload Card

With bit data rates now in the gigahertz range, the new generation of switched serial fabrics can easily rival their parallel counterparts. One of the major benefits of new serial interfaces is the reduced number of signal lines and smaller connectors and cable. This delivers enhanced system density, simpler system integration, lower installation costs, and easier maintenance. Another benefit is the ability to use copper cables for low-cost local connections or optical cable for fast, long-haul data transmission channels. The physical layer can be made completely transparent to the protocol layer.

Yet another benefit of serial links is the ability to gang together multiple serial links to boost data throughput. Since the signal within a single bit link contains embedded clock and timing information, each link can propagate on its own across the channel and transceivers at each end can handle the multiplexing and demultiplexing for 1x, 4x, 8x or 16x ganging in low-level hardware layer devices.

Once the benefits of switched serial fabrics became apparent, embedded systems vendors sought ways to take advantage of this technology for a wide range of interconnection needs: boards to peripherals, boards to boards, chassis to chassis, and facility to facility. Not only are switched serial fabrics attractive alternatives to existing technology for front panel interconnections, they are also extremely appropriate for backplane data traffic to augment or replace the conventional parallel backplane bus.

Embedded system vendors are now faced with choosing from among many contending switched serial fabrics. Infiniband is primarily aimed at server and storage system connectivity for box-to-box links. StarFabric's strength lies in providing transparent serial links between PCI devices. PCI Express is Intel's initiative for connectivity between processors and boards in personal computers and workstations. Hyper Transport is AMD's solution for chip-to-chip and board-to-board connections in personal computers. RapidIO is targeted for chip-to-chip and board-to-board connections for real-time COTS embedded systems and has strong support from Motorola.

These five fabrics are all vying for position. Aside from some valid technical pros and cons for each fabric, the key issues for switched fabrics tend to be business issues. For example: Which major vendors are backing each standard? How easily can these new fabrics be integrated into existing software operating system environments? What components are available for bridging to existing hardware and processors? What kinds of switches are available? And finally, can the fabric technology parts achieve a sufficiently high volume of production to make the parts inexpensive, power efficient and easily connected?

During the last few years, the VITA 41 committee of the VMEbus Standards Organization has been defining a switched serial backplane fabric for VMEbus called VXS. VXS promises to solve even the most challenging data transfer requirements of real-time embedded systems as faster processors and interfaces emerge. It will assure the continuing popularity of VMEbus by allowing legacy boards to coexist with the new VXS versions as they become available. The specification defines a VXS Payload Card, a VXS Switch Card and a connector scheme for various possible backplanes to support VXS.

Because of the "fabric wars", the VXS specification was defined to be fabric agnostic, in that there are five sub-specifications, one for each of the five fabrics described above. The basic switched fabric architecture chosen to connect the boards across the backplane was a ganged 4x, full-duplex serial channel. This means that each interconnect supports data flow in both directions simultaneously.

Serial bit rates are defined for frequencies up to a maximum of 10 gigabits/second, although lower frequencies are supported for the first systems. With the 4x ganging and a nominal bit frequency of 2.5 GHz, the input path and output

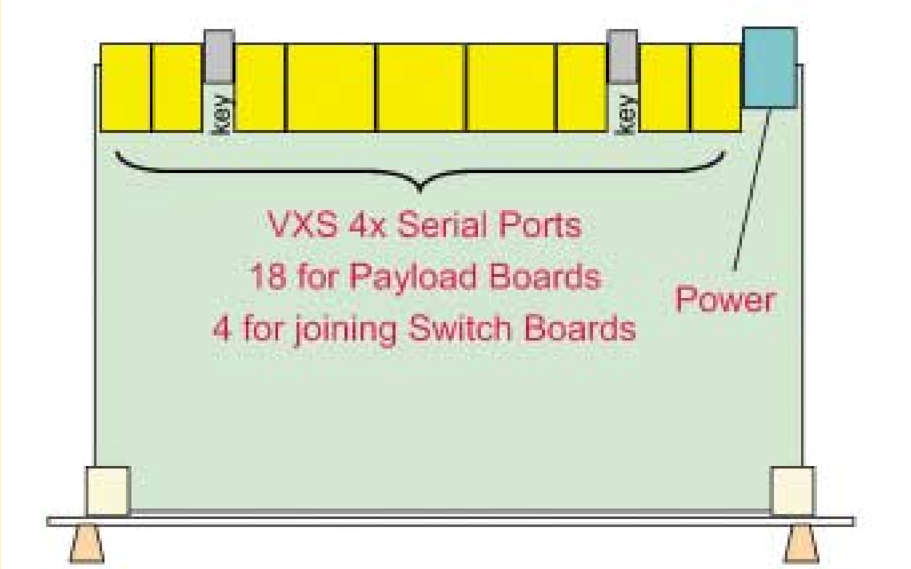

Figure 2. VXS Switch Card

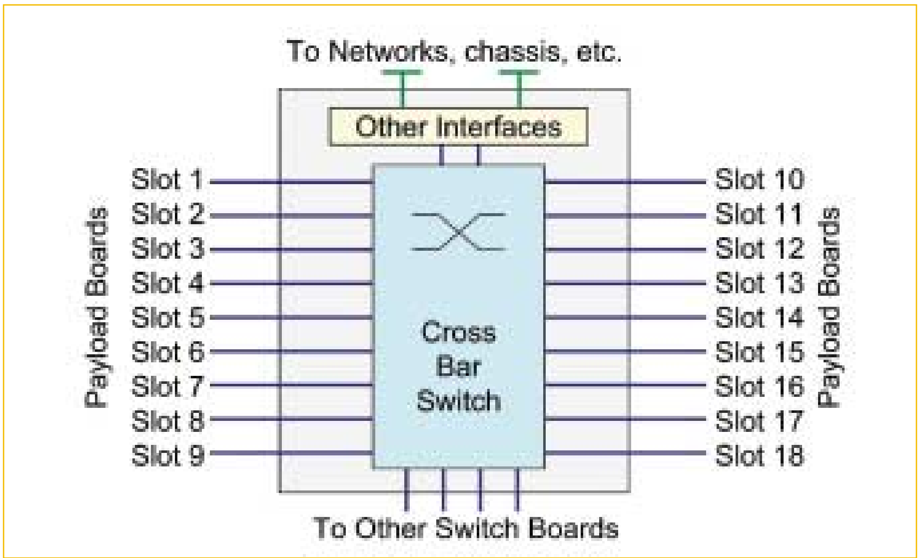

Figure 3. Example of VXS Switch Card

path are both capable of moving data at 1 GB/sec. The VXS Payload cards are processor, CPU, memory, and data converter 6U VMEbus cards with the VXS interface added. They have standard P1 and P2 connectors that implement the standard VME64x backplane interface. A new P0 backplane connector mounted between P1 and P2 handles two 4x, full duplex switched serial ports. Figure 1 shows a simplified view of the payload card and the new VXS P0 connector At a 2.5 GHz clock frequency, each VXS Payload card can move data in and out at an aggregate rate of 4 GB/sec, two orders of magnitude above the original VMEbus backplane specification.

The VXS Switch card has a 6U VME board form factor, but unlike the Payload card, no P1 and P2 connectors. Instead, the space normally used for the P1 and P2 connectors along the rear edge of the board is populated with a power connector and connectors that handle up to eighteen 4x full-duplex serial links. The VXS Switch card implements the crossbar switching to connect Payload Cards together. Figure 2 shows a view of the VXS Switch card. VXS Switch cards can have any number of crossbar switches and any number of serial ports. They may also include other interfaces to networks for communication and storage devices, as well as front panel serial ports to other VXS Switch cards in the same chassis or in adjacent racks. Optical serial ports could be used for remote high-speed data transfers. Figure 3 below shows one possible block diagram for a VXS Switch card supporting the maximum number of serial interfaces, a total of 18.

The VXS Backplane can take on many different layouts to accommodate specialized system needs, but will normally handle two to twenty Payload cards and one or more Switch cards. The standard board-to-board pitch of 0.8

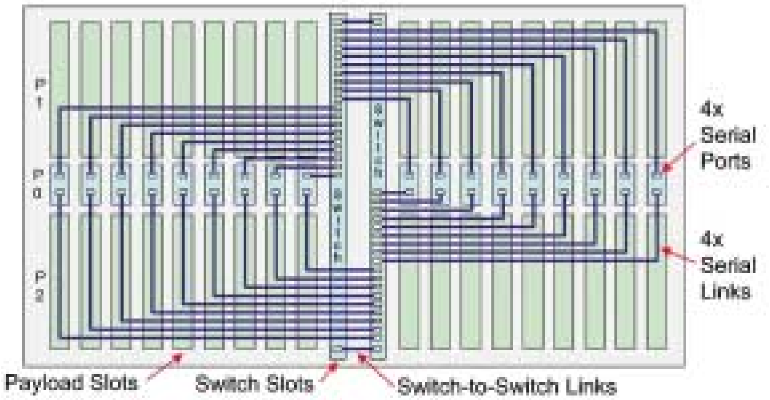

Figure 4. Example of a 20-slot VXS backplane

inches is maintained throughout, and other VMEbus card cage mechanical hardware (card guides, frames, etc.) is compatible. The objective is to connect the two 4x serial links of each Payload card to links on the Switch card(s) to support the necessary board-to-board connectivity. Some smaller systems may require only a few Payload slots and a very simple Switch card, while others may need to use a full width backplane and multiple Switch cards to handle the required traffic. Figure 4 shows one example of a 20-slot VXS Backplane that holds 18 Payload cards divided equally in each half, and two Switch cards occupying the two center positions. One serial link from each Payload card is wired to one of the Switch cards while the second serial link of the Payload card is wired to the other Switch card.

Since there are a maximum of 18 serial link connections on each Switch card, all 18 Payload cards can be connected to each other through two redundant paths, namely through both of the two Switch cards. This dual redundancy is attractive for many applications requiring fault tolerance and high availability. Note from figure 3 that the two Switch cards also have additional serial links that join Switch cards together, providing yet another path for routing.